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EXAMINER
RAO, SHRINIVAS H

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2814	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/418,029	Applicant(s) CHAN ET AL.	
	Examiner Steven H. Rao	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 May 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14 and 16-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-14 & 16-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Response to Amendment

Applicants' amendment filed April 23, 2002 has been entered on May 03, 2002.

Therefore claims 4-5, 11,16, 17and 23-24as amended by the amendment, claims 1-3, 6-10, 12-14, 18-22 as originally filed are currently pending in the application. Claim 15 has been cancelled by the amendment.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-8,11, 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh (U.S. Patent No. 5,141,896, herein after Katoh) and Ito (U.S. Patent o. 6,297, 145, herein after Ito) both previously applied for reasons set out in the previous rejection and those set out below.

With respect to the above claims it is noted that Applicants' are attempting to provide piece meal attacks on the references, which has been prohibited at least from 1981.

In response to Applicants' piecemeal analysis of the references, it has been held that one cannot show non obviousness by attacking references individually where, as here, the rejections are based on combinations of references. In re Keller, 208 USPQ 871 (CCPA 1981).

However, with a view to move forward even assuming the attacks on individual references are some how permitted, the prior art of record discloses all the alleged novel features as shown below:

Applicants' first contention is Katoh does not disclose mechanically stable air gaps between metal lines .

Katoh in col. 2 lines 5-10 states :

> the semiconductive substrate. The second structure of the multilevel interconnection is a quasi air gap metallization structure. This construction has markedly improved thermal and mechanical strength compared with the above-mentioned aerial interconnection construction, but the reduction of coupling capacitance between interconnection levels is not so large as the aerial interconnection construction.

Applicants' next state that Katoh does not teach conductive layers of inter connect separated by multiple layers of dielectric in order to create a dielectric of low dielectric constant.

Katoh in col. 1 line 67- col. 2 line 4 states :

> interconnections on the same level. The first structure of the multilevel interconnection has the intermediate insulating films formed in wall-like shape, with the lower end of the intermediate insulating films reaching an underlying insulating layer formed on the surface of the semiconductive substrate. The second structure of

Applicants' next contend the Katoh creates crossing points for interconnects while instant invention creates mechanically stable air gaps between metal lines.

Katoh in col. 2 lines 5-10 states :

> the semiconductive substrate. The second structure of the multilevel interconnection is a quasi air gap metallization structure. This construction has markedly improved thermal and mechanical strength compared with the above-mentioned aerial interconnection construction, but the reduction of coupling capacitance between interconnection levels is not so large as the aerial interconnection construction.

Applicants' contend that Katoh teaches the channel or trenches being filled with insulating material that are not removed, whereas the nitride layer is removed to form the air gaps in the invention.

Katoh in fig. 2 (d) etc. col. 5 lines 29-40 states:

> film 3 is retained. Next as shown in FIG. 2(*d*), via holes 5 are opened at desired positions in the first inter-level inorganic insulating film 3 by means of an ordinary photolithography method.

Additionally as stated in the previous office action, Ito describes the removal of nitride in col. 8 lines 1-2 and fig. 13.

Applicants' individually attack Ito for the following reasons.

Ito does not teach the creation of overlying layers of interconnects that are separated by layers of dielectric in which air gaps have been provided.

The rejection is based upon the combined teachings of Katoh and Ito and Katoh in col. 2 lines 5-10 states :

> the semiconductive substrate. The second structure of the multilevel interconnection is a quasi air gap metallization structure. This construction has markedly improved thermal and mechanical strength compared with the above-mentioned aerial interconnection construction, but the reduction of coupling capacitance between interconnection levels is not so large as the aerial interconnection construction.

Applicants contend that Ito's construction of its structure has no similarity with the structure shown in fig. 8 (a) of the instant invention.

However it is the recited claims that are rejected and not what is shown in the figures of the instant application.

Further, Ito in figs. 7(a) and (b) and col. 9 lines 13-17 shows and describes structure identical to fig. 8(a) of the instant application.

Ito col. 9 lines 13-17 :

> Next, as shown in FIG. 7(*b*), using the fourth silicon oxide film **23** as a mask material, the second interlayer insulation film **21** and the third silicon oxide film **18** are etched, thereby forming the post opening part **27** and the via hole opening part **28**. At the bottom part of the post opening part **27**, the insulation post **35** is exposed

Applicants' contend that Ito teaches only silicon nitride layers as supporting insulating posts and not to create air filled spacing.

Ito in fig. 2(b) and col. 7 lines 41- 45 states ;

> Next, as shown in FIG. 2(*b*), using the first silicon oxide film **5** as a mask material, the first silicon nitride **4** and first interlayer insulation film **3** are etched, thereby forming the support opening part **9** and the via hole opening part **10**. The

Applicants' next contend that Katoh and Ito do not teach the first and second layer of oxide used to create holes there trough so disposable material can be removed from the trenches, the second to close the created air space after trenches have been opened. (see previous rejection and above).

With respect to claim 11, Applicants' contend that prior art does not teach the removal of the other materials from the trenches.

Ito in col. 9 lines 19-32 states :

> Next, as shown in FIG. 8(*a*), silicon oxide film grown and anisotropic etching are used to completely fill the via hole with the silicon oxide film **29**, and to leave the silicon oxide film **29** on only the side wall part of the post. Then, silicon nitride film etching is done for a short period of time so as to remove the first silicon nitride film **22**.
>
> Next, as shown in FIG. 8(*b*), after using CVD to form a silicon nitride film **31** over the entire surface, the CMP method is used to leave the silicon nitride film **31** on only the post part, thereby forming the insulation post **36** immediately above the in insulation post **35**.
>
> Next, as shown in FIG. 9(*a*), oxide film etching is done to remove the silicon oxide film 29 of the via hole part.

Claims 2-3 were alleged to be allowable because they depend upon allegedly allowable claim 1.

However as shown above claim 1 is not allowable and therefore claims 2-3 are also not allowable and are rejected for reasons stated above.

Claims 4-5 have amended to overcome 112 rejections and have no other substantial changes therein. And are rejected for reasons set out above.

Claim 6 is alleged to allowable because it recites, " interconnect traces even where these interconnect traces are relatively far removed from each other and is rejected for reasons stated above, it is noted that the applied references can also be performed when the traces are relatively far removed. (Katoh col. 1 lines 20-24)

> In recent years, the integration density of semiconductor devices has been raised and the mutilevel interconnections have been used more frequently, as the scale of the system realized by the use of semiconductor devices is increased and the fabrication technology for semiconductor devices with fine geometry is advanced.
>
> With the increase in the integration density of semiconductor devices, the space between the interconnections also decreases. Because of this, the parasitic capacitance incidental to the interconnections increases.
>
> In order to reduce such parasitic capacitance, it has been proposed to remove an inter-layer insulation film to make the space between the interconnection layers vacant, by supporting the upper layer interconnections only by contact pillars at via hole positions, in a report

Claims 16-20 repeat the steps of claim 4-8 and depend upon claim 11 and are rejected for reasons stated above.(w.r.t claims 11 and 4-8).

Therefore all of applicants' arguments with regard to claims 1-8,11 and 16-20 are not persuasive and are rejected for reasons previously stated and those stated above.

Claims 9-10,12-15, 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh (U.S. Patent No. 5,141,896, herein after Katoh) and Ito (U.S.

Patent o. 6,297, 145, herein after Ito) as applied above and further in view of Havemann et al. (U.S. Patent No. 5,461,003, herein after Havemann) all previously applied for reasons set out in the previous rejection and those set out below.

Applicants' state that the arguments regarding Katoh and Ito are not repeated here and similarly The Examiners' response to Applicants' argument is incorporated by reference.

Applicants' next individually attack Havemann as failing to shown the following .

With respect to the above claims it is noted that Applicants' are attempting to provide piece meal attacks on the references, which has been prohibited at least from 1981.

However, with a view to move forward even assuming the attacks on individual references are some how permitted, the prior art of record discloses all the alleged novel features as shown below:

a) creating over layers of insulating material (Katoh fig.1 or Ito).

b) Etching first and second network of trenches (Ito)

Claims 9 -10 and 12 are said to distinguishable because Havemann teaches different processing sequence.

It is settles law from at least from 19460 that, " As a matter of fact selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results. In re Burhaus, 154 F.2d 690, 69 USPQ 330 (CCPA1946), See also Ex parte Rubin and In re Gibson.

Claim 13-15 were alleged to be allowable because parameters of design have significant effects. It is well settled that design parameters cannot be given patentable weight. " A change in size is generally recognized as being within the level of ordinary skill in the art. In re Rose, 105 USPQ237 (CCPA 1955).

Therefore claims 13-15 are not patentable for reasons previously stated and those stated above.

Claims 20-21 were said to be patent able because they depend upon different independent claim.

However as claim 11 from which claims 20-21 depend is rejected, claims 20-21 are also rejected.

Claim 23 was said to be allowable because it recites depositing a layer of metal on the surface of the substrate and etching said layer of metal to form metal leads. (See Havemann col. 5 lines24-26 and fig. 1A, as stated in the previous office action).

Claim 24 was alleged to be allowable for reasons stated under claims 4-5. 16 and 17

Therefore applicants' arguments with respect to claims 9-10,12-15,21-24 are all considered but not persuasive and all the afore mentioned claims are rejected for reasons stated above.

Response to Arguments

Applicant's arguments filed 5/3/02 have been fully considered but they are not persuasive for reasons set out in detail above.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action.

Further as the same references as previously applied are also used here this forms a separate basis for making this action Final.

Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703)3062794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 7463926 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 3067722.

Steven H. Rao

Patent Examiner

July 14, 2002

OLIK CHAUDHURI
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